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(54) A prefabricated, light reflecting, strip or tape-form road marking material and methods of preparing same and component parts thereof.

(57) This invention concerns a method for making prefabricated, light-reflecting, roadway-marking strips resistant to the scraping action of mechanical, snow-clearing equipment - such as snow plows - by the application of protruding elements on the marking strip. These elements can be of different shapes and are positioned on the marking strip so as to promote the snow plow blade to lift over the light reflecting elements, thus preventing, at least partially, the otherwise serious damage that could occur to the said light-reflecting elements. The protruding elements are also designated to provide lifting points for the removal of the marking strip from installed locations on roadway surfaces.

The light-reflecting elements can also be mounted onto the protruding elements.

This invention also concerns the method for manufacturing the protruding elements, the method for the manufacture of the basic strip and the relative finished marking strip.

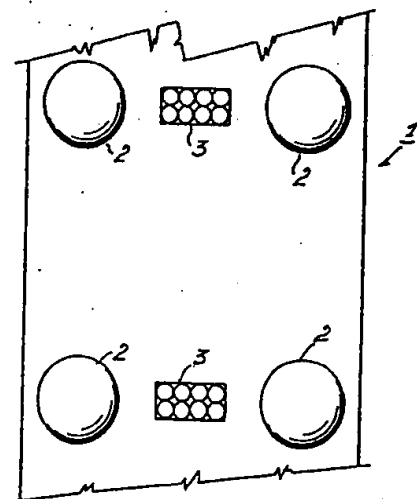


Fig. 1

A prefabricated, light reflecting, strip or tape-form road marking material and methods of preparing same and component parts thereof

5 This invention generally relates to prefabricated, light-reflecting, horizontal roadway marking strips and more specifically is concerned with the problem of resistance to the scraping action of mechanical, snow-clearing equipment - such as snow-plows.

10 Marking strips that are installed horizontally on the surfaces of roadways - especially the kind of strips which incorporate light-reflecting elements for making them plainly visible at night and in rainy weather - can be severely damaged when contacted by snow-clearing equipment.

15 Furthermore, when the formation of ice on the roadway surface is particularly hard to remove, even with the use of salt solutions, and the use of equipment having metallic or carbide metal blades becomes indispensable, damage to the retroreflecting optical elements during the road-clearing operation is practically complete, whereby the marking strip will no longer be readily visible in rainy weather or at night.

20 In previous inventions made by the applicant - Italian applications 22352 A/76 and 30886 A/76, filed on April 15th and Dec. 12th, 1976, respectively, corresponding to the issued US-Patent No. 4,129,673 - it was proposed that the optical elements be protected by means of continuous, protruding rails, or similar arrangements, which would provide a surface over which

the snow-plow blade could slide and thus avoid damage to the optical elements.

5 In a more recent patent application of the applicant - Italian Application No. 22584 A/82, filed on July 27, 1982, partially corresponding to applicants' European patent application No. 83107402.6 of July 27, 1983 -  
10 particular consideration was given to the problems in connection with the necessity of snow-plow operations on main roads and highways having to be made at high speeds. For the solution to these problems, said prior invention provides for the use of compressible components - consisting of elastomers - which, together with rails,  
15 cause the snow-plow blade to lift clear of the retro-reflecting elements while, at the same time, the retro-reflecting elements are pressed down below the plane of the roadway surface.

20 Highly efficient roadway marking strips incorporate optical elements which are exceptionally large, and this makes the use of the compressible-element design indispensable.

25 It is therefore an object of this invention to provide another solution to the problem of efficiently protecting these optical elements, provided that the size of the optical elements keeps within acceptable limits, without having to resort to the use of compressible elements described in patent application 22584 A/82.

30 To this effect, in accordance with the basic idea of the present invention, the rails described in forementioned patent applications 22352 A/76 and 30886 A/76, are

replaced by protruding elements which are appropriately spaced along the marking strip so as to take advantage of the snow plow's kinetic energy and rebound hysteresis and cause the plow blade to bounce from one protruding element to the next, thus avoiding - within practical limits - any damage being caused to the optical elements by the passing plow blade.

These elements can be of different shapes and are positioned on the marking strip so as to promote the snow-plow blade to lift over the light-reflecting elements, thus preventing, at least partially, the otherwise serious damage that could occur to the said light reflecting elements. As examples, the protruding elements can be button-shaped, lozenge-shaped or have any other kind of appropriate shape and have a rectangular or a rounded, convexed cross-section. They can either be lined up in straight rows on the marking strip or be staggered.

The light-reflecting or retroreflecting elements, hereafter also referred to as retroreflecting pearls or, more generally, as optical elements, can also be mounted onto the protruding elements themselves.

The protruding elements are also intended for use as lift points when desiring to remove the installed marking strips from the installed location on the roadway surface.

This invention also regards the method of manufacturing protruding elements, the method of manufacturing the basic strip and the relative completed marking strip.

Further aspects and advantages of the invention will proceed from the following detailed description of preferred embodiments of the invention in connection with the drawings. In the drawings

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Fig. 1 is a schematic representation of a portion of a tape or strip-shaped road marking material in plan view from above,

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Fig. 2a and 2b are schematic side views of the protective elements protruding from the exposed surface of the road marking material of the present invention, at different stages of their working life in operative condition,

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Fig. 3 shows, in schematic side view, a protective protruding element covered with optically active elements, in accordance with a preferred embodiment of the invention,

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Fig. 4 and 5 show in schematic side view apparatus and installations used for manufacturing the protruding protective elements, in accordance with preferred methods of manufacture of the invention.

25

30 Fig. 1 shows a portion of a strip or tape-like road marking material 1, with protruding elements 2 lined up in several rows. At 3 there are shown schematically retro-reflective optical elements for visibility of the marking under the light emitted from the vehicle headlights. ./.

These optical elements are shown in an exemplary schematic manner only and may be of any of the various well known constructions for this purpose. Protruding elements initially having a rectangular cross-section - regardless of their outer shape - will cause the snow-plow blade to make an inclined angle with the surface of the protruding elements and thus act as a cutting tool on the elements which thereby will increasingly adopt a ramp-like shape in the direction of forward travel of the snow plow equipment. Figure 2a shows the cross-section of the protruding element 2' when new, and Fig. 2b shows the same cross-section 2'' after the snow-plow blade has made several passes over it.

These conditions will, of course, be obtainable only if the protruding elements are made of a material having exceptional mechanical properties, which includes such materials as thermoplastic polyurethane, shock-resistant polymethacrylate and polycarbonate.

In accordance with a concomitant aspect of this invention the protruding elements 2 can also have retroreflective pearls mounted on them, covering the tops and sides. Fig. 3 shows an embodiment of this type with a disk-shaped protruding element 2 being covered on the top and sides with the aforementioned pearls 4.

Fig. 4 shows a method for producing these disk-shaped protruding elements, starting with an extruded, solid cylinder (10). Upon being extruded, the cylinder is sprayed (12) with a bonding substance and then with appropriately-sized retroreflective pearls (14). The disks are then cut (16) to the desired thickness.

Best results are obtained with protruding elements having a rounded or convex cross-section, which permits a more uniform bouncing action of the plow blade. This type of protruding elements can be produced by either injection or compression molding, but are most economically produced by extrusion through die rollers. Fig. 5 in its lower portion shows a protruding element of this type in convex cross-section (18), and in its upper or main portion shows a method of production for such elements, using counter-rotating cylinders (20' and 20'') located downstream the extrusion head (22). This method of production is completely analogous to the one described in the issued US Patent No. 4,072,403. Particular reference is made to Fig. 5 of this patent. The best way of applying the protruding elements to the marking strip is to use the same method used for applying the optical elements. After the basic support strip has been coated with a bonding liquid, and before the liquid has had a chance to harden, the protruding elements are appropriately located on the marking strip. Both the bonding liquid and the protruding elements are best made of polyurethane.

Best results are obtained by starting off with a very thin, polyurethane support strip, such as a non-woven fabric, and impregnating it with a thermoplastic polyurethane solution (see issued US Patent No. 4,146,635), using well-known techniques; then covering the impregnated strip with a polyurethane marking film such as that described in issued US Patent No. 4,020,211; and then, before the film hardens, allowing rounded-off type buttons - such as produced by the roller-die extrusion of thermoplastic polyurethane - to drop onto the strip.

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The temperature of the impregnating, thermoplastic polyurethane is compatible with that of the thermoplastic bituminous primers, as described, for example, in issued US Patent No. 4,102,718.

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The protruding elements may be also applied to the marking strip by suitably laying down a "hot melt" (thermo-fusible) adhesive, followed by the positioning on same of the protruding elements.

10

In accordance with another concomitant aspect of the protruding elements, which also forms part of this invention, the protruding elements can be used for facilitating the lifting of the marking strip from its installed position, if removal of the tape is desired. The protruding elements, in fact, constitute attachment points for effecting removal of the marking strip.

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The foregoing illustrations and descriptions have been given only to serve as examples and in no way imply any limitations. Thus, the invention could be applied in various other ways and incorporate numerous modifications without going beyond the original scope of this invention as defined in one or more of the following claims.



C l a i m s

1. A method for making a prefabricated, horizontally-  
installed type, light-reflecting, strip or tape-like  
road marking material comprising optical retro-  
reflective means protruding from the surface of the  
road marking strip material, for providing or  
enhancing visibility thereof, and further comprising  
means for protecting the optical means from the  
scraping action of snow-plow blades of snow-clearing  
equipment travelling along the road,  
c h a r a c t e r i z e d in that said protective  
means comprise protruding elements (2) applied to  
and adherent on said marking strip,<sup>(1)</sup> positioned  
and spaced in such a way as to protect the optical  
elements (3) by causing the rapidly-passing snow-  
plow blade to bounce from one protruding element  
to the other, thus at least partially avoiding the  
blade from doing damage to the optical elements.
2. A method, as per claim 1,  
c h a r a c t e r i z e d by the fact that the pro-  
truding elements (2) have a disk shape.
3. A method, as per claim 1,  
c h a r a c t e r i z e d by the fact that the pro-  
truding elements (2) have a rounded-off, convex  
shape (18, Fig. 5).
4. A method, as per claims 1 to 3,  
c h a r a c t e r i z e d by the fact that retro-  
reflecting components 4, Fig. 3; 14, Fig. 4) are

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applied to the protruding elements.

5 5. A method as per claims 1 to 3,  
c h a r a c t e r i z e d by the fact that retro-  
reflecting components are applied near to the pro-  
truding elements.

10 6. A method, as per claims 1 to 5,  
c h a r a c t e r i z e d by the fact that the  
protruding elements are made of thermoplastic poly-  
urethane.

15 7. A method, as per claims 1 to 5,  
c h a r a c t e r i z e d by the fact that the  
protruding elements are made of shock-resistant  
polymethacrylate.

20 8. A method, as per claims 1 to 5,  
c h a r a c t e r i z e d by the fact that the  
protruding elements are made of polycarbonate.

25 9. A method, as per claims 1 to 8,  
c h a r a c t e r i z e d by the fact that the  
disk-shaped protruding elements are produced by  
cutting from an extruded rod (10, Fig. 4) having  
a circular cross-section.

30 10. A method, as per claim 3,  
c h a r a c t e r i z e d by the fact that the  
rounded-off, convex-shaped protruding elements (18)  
are produced by injection molding.

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11. A method, as per claim 5,  
c h a r a c t e r i z e d by the fact that the  
rounded-off, convex-shaped protruding elements  
are produced by compression molding.
12. A method, as per claim 5  
c h a r a c t e r i z e d by the fact that the  
rounded-off, convex-shaped protruding elements (18)  
are produced by passing extruded material (22)  
10 through counter-rotating die rolls (20', 20'', Fig.  
5).
13. A method, as per one or more of the claims from  
1 to 12,  
15 c h a r a c t e r i z e d by the fact that the  
protruding elements (2) are applied to the marking  
strip (1) in opportunely located positions on the  
marking-strip film before the film hardens.
- 20 14. A method, as per one or more of the claims from  
1 to 12,  
c h a r a c t e r i z e d by the fact that the  
protruding elements are applied to the marking strip  
by means of suitably laying down a "hot melt"  
25 (thermofusible) adhesive, followed by the posi-  
tioning on same of the protruding elements.
- 30 15. A road marking material as obtained in accordance  
with any one or more of claims 1 to 14,  
c h a r a c t e r i z e d by the fact that the  
protruding elements (2) also serve as lift points  
for mechanically lifting or raising the marking  
strip from its installed position on the roadway

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pavement, if removal of the tape is desired.

5 16. A method of manufacturing strip or tape-like horizontal road marking material as obtained in accordance with any of the preceding claims which material is particularly unaffected by the passing over it of snow-plow blades because of its fineness,

10 characterized by the fact that a non-woven fabric is impregnated with a solution of thermoplastic polyurethane and then covered with a marking-strip film made of polyurethane, whereafter protruding elements made of die-rolled, extruded, thermoplastic polyurethane are opportu-

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15 nely positioned on the film before the film hardens.

17. A method of producing a marking strip material, in accordance with claim 16,

20 characterized by the fact that the rounded-off, convex-shaped protruding elements are made by injection molding.

18. A method of producing a marking strip material in accordance with claim 16,

25 characterized by the fact that the rounded-off, convex-shaped protruding elements are made by compression molding.

30 19. A prefabricated strip or tape-like horizontal road marking material as produced and obtained in accordance with one or more of the preceding claims.

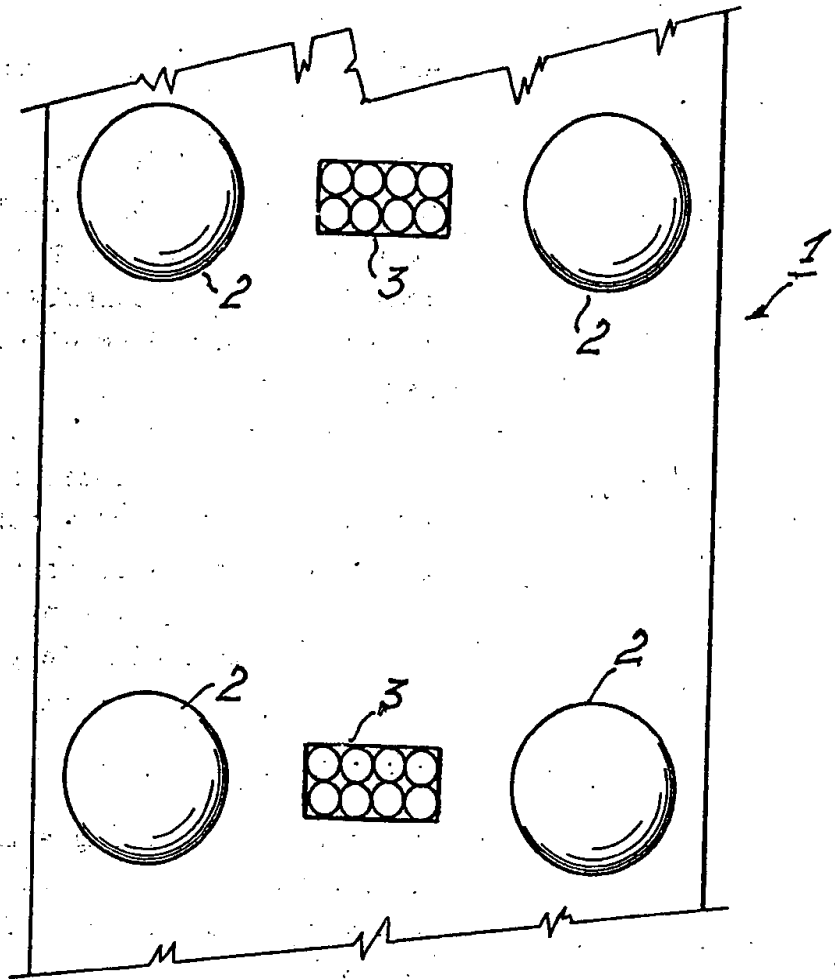
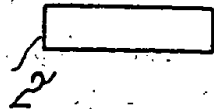
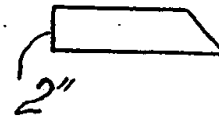
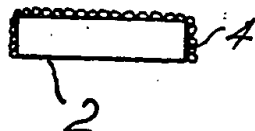
$\frac{1}{2}$ Fig. 1Fig. 2a)Fig. 2b)Fig. 3

Fig. 4

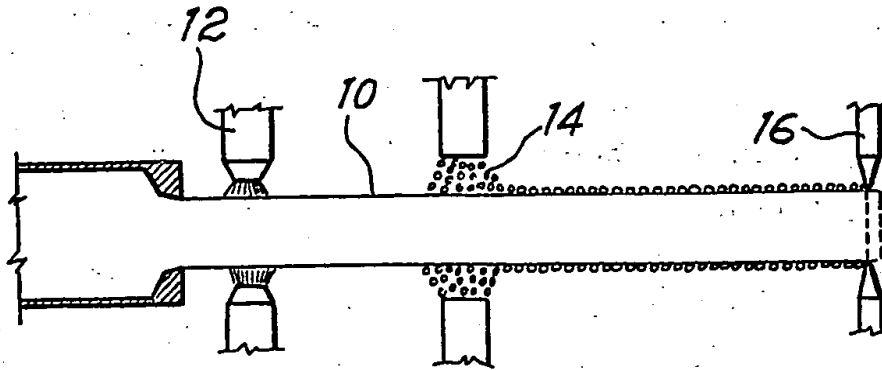


Fig. 5

